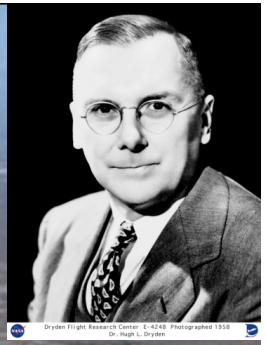
# Dryden Flight Research Center

"…to separate the real from the imagined…to make known the overlooked and unexpected."



Dryden Flight Research Center E-4248 Photographed 1958
Dr. Hugh L. Dryden

## Edwards Air Force Base

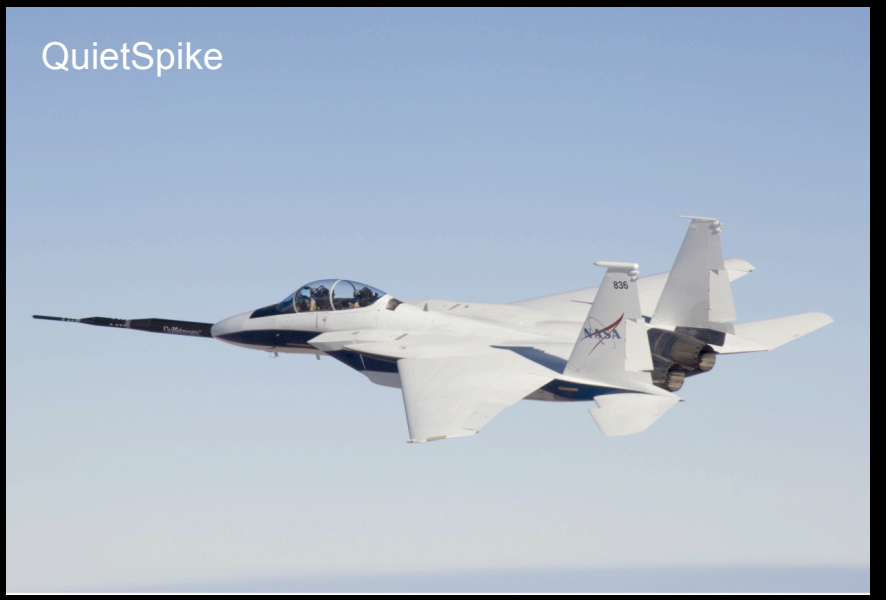
- Remote Location
- Varied Topography
- 350 Flight Testable Days Per Year
- Extensive Range Airspace
- 29,000 Ft Concrete Runways
- 68 Miles of Lakebed Runways
- 301,000 Acres
- Supersonic Corridor

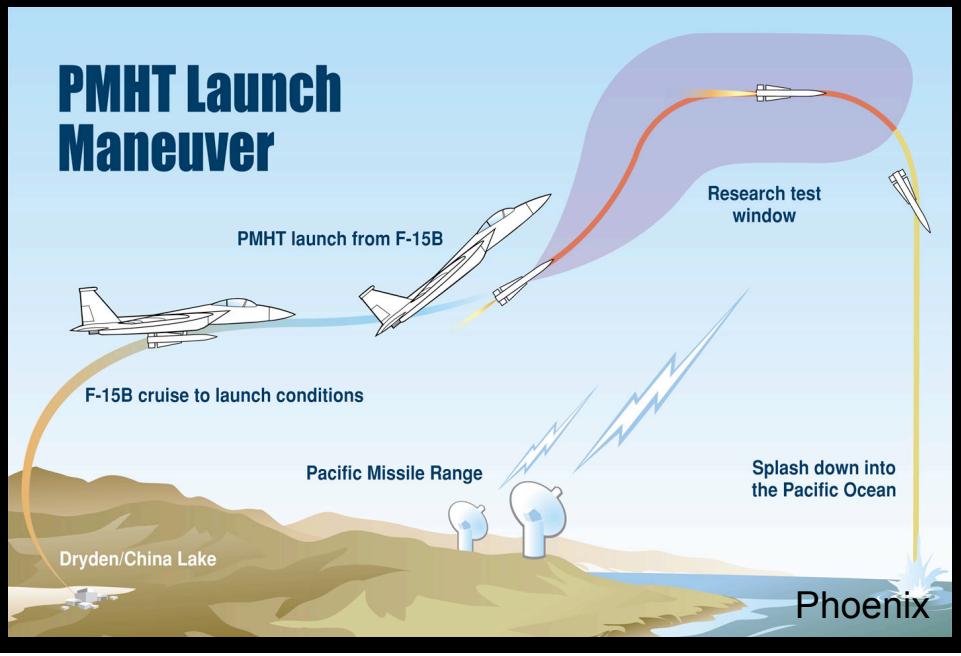
**NASA Dryden Flight Research Center**

# Mission Support: ARMD (current and recent)

- Subsonic Fixed Wing
  - X-48B
  - Fiber Optics System
  - ASE Flexible Wing Motion Control
  - Advance Experimental Systems
- Hypersonics
  - Phoenix Hypersonic Testbed
  - Ruddervator
  - IR Pulsed Thermography
  - Extreme Environment Sensors
  - Transpiration Cooling
  - Flush Air Data System Development
  - Heat Flux Measurement Uncertainty
  - Hypersonic Sim Development
  - X-51 Advocacy
  - FALCON Advocacy
- Supersonics
  - LaNCETS
  - QuietSpike
  - Shaped Sonic Boom Study
  - Oblique Flying Wing Advocacy
  - Supersonic Transition Studies
- IRAC
  - Adaptive Flight Controls (F15 837 & F18 853)
  - C-17 Engine Performance
  - PCARS Phase 1
- IVHM
  - Sensor & System Integration
  - Airframe Health Management Detection
  - Propulsion Gas Path Health Management

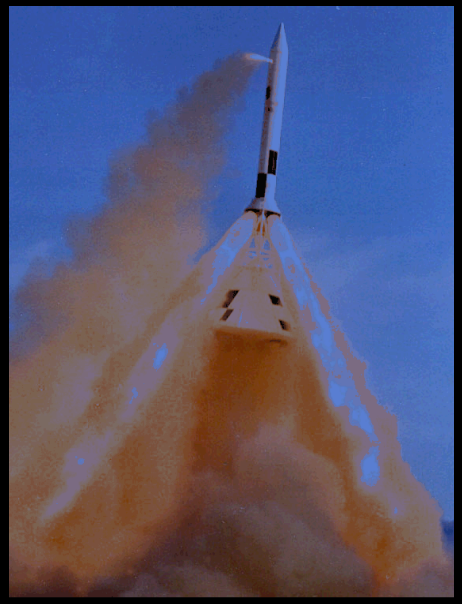
# Mission Support: ARMD

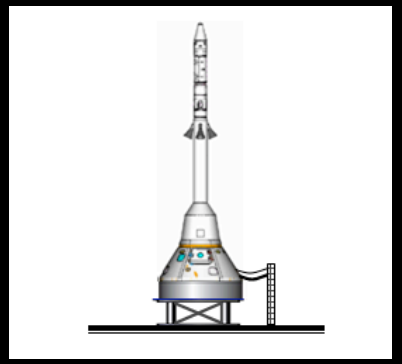



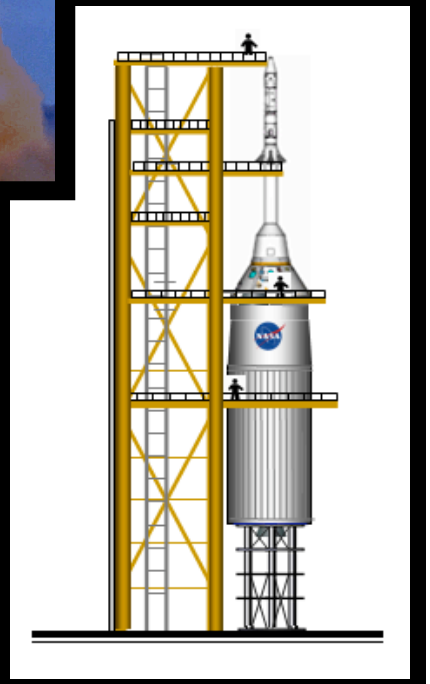




# Mission Support: ESMD

- Abort Flight Testing (FY08-14)
  - Developmental Flight Instrumentation for FTV
  - Flight Test Integration and Support
- Lunar Reentry Testing
- Possible Lunar Lander flight test & CEV landing site







# Mission Support: Science – ER-2

***Background and Status***

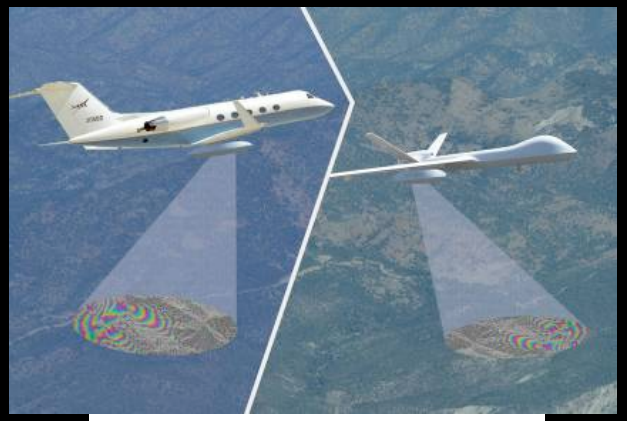
- U-2 and ER-2 aircraft have been a mainstay of NASA airborne sciences since 1971
- Over 100 science instruments integrated
- Continuous capability improvements
- Two aircraft currently available for:
  - Remote sensing
  - Satellite calibration/validation
  - In-situ measurements and atmospheric sampling
  - Instrument demonstration, test and evaluation

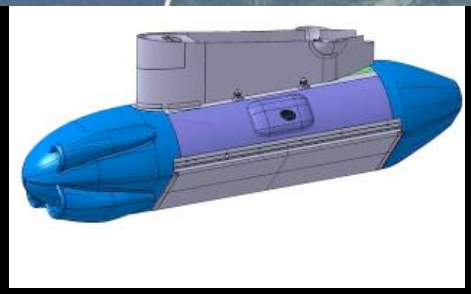

***Mission Support Features***

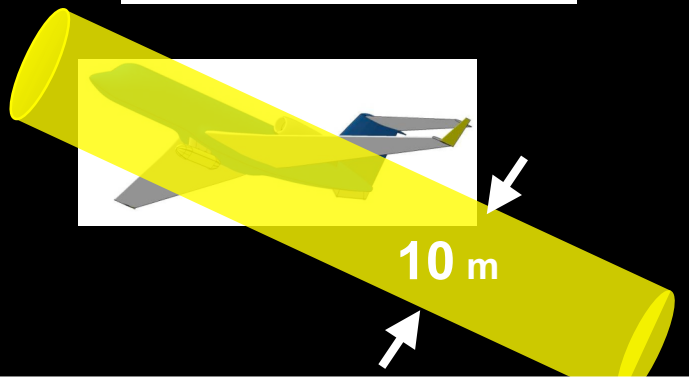
- Multiple locations for payload instruments
- Pressurized and un-pressurized compartments
- Standardized cockpit control panel for activation and control of payload instruments.
- Iridium communications system
- World-wide deployment experience

# Mission Support: Science – G3 UAVSAR

- ***Mission Objective***
  - Provide new capability for solid earth science
    - Airborne repeat-pass radar imaging
    - Interferometric mapping of deforming surfaces
- ***Organization***
  - Program Office: ESTO
  - Instrument Dev. Lead:  JPL
  - Platform Dev. Lead: DFRC
- ***Description***
  - Pod mounted instrument
  - < 10 m tube flight path using JPL real-time DGPS and Dryden Platform Precision Autopilot
  - Compatible with Gulfstream G-3 or UAS








**10m flight path precision is expected, based on recent flight tests**

# Mission Support: Science – Ikhana

***Mission Support Features***

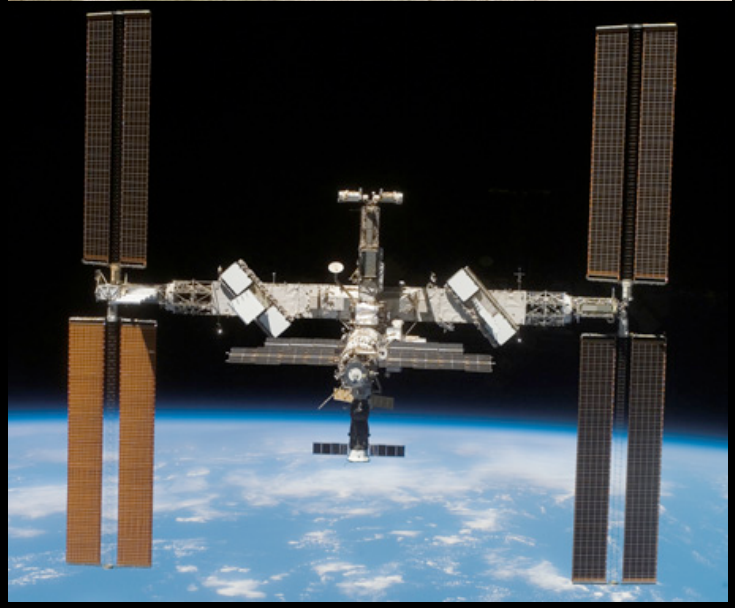
- Airborne Research Test System
  - enables effective flight control research
- Mobile ground control station
  - supports campaign deployment
- External experimenter pod
  - rapid/flexible experiment integration


# Mission Support: Space Operations

- Management, coordination and oversight of:
  - Dryden Shuttle Landing, Recovery, & Turn-around Operations
  - Shuttle Training Aircraft (STA) Flight Operations at Edwards
- COTR of Dryden Shuttle Support Services Contract (LMMS), which also includes
  - Technical Training Facility
  - Metrology Facility
  - Aerospace Energy Systems Facilities

# Mission Support: Space Operations

- Lift-off to landing (12 hour windows) s-band telemetry and c-band (radar) monitoring
- Vector validation for docking maneuver (Shuttle and ISS) beginning several days prior
- ISS emergency contingent site
  - VHF communication ground stations (pass on to current monitor JSC/Moscow)



# TFAWS Related Work at Dryden: Fluids


- Tools
  - SolidWorks – COSMOSWorks (FEA)
  - SolidWorks – Gridgen/ICEM CFD – VULCAN or WIND or Fun3D
  - Post processing – FIELDVIEW or Tecplot
  - Mostly Linux based, 1 cluster coming online, 1 cluster online but not yet operational [20 node Pentium 4 / Gigabit Ethernet Linux Beowulf Cluster w/ TetrUSS software system]
- Significant Projects
  - X-43A MIB
  - F-15 ACTIVE thrust vectoring nozzle
    - Found interesting flow physics
  - Aerospike Nozzle
  - CIAM Scramjet
- Test Facilities
  - Aircraft (F-15, F-18, F-16 XL not flying, G3, T-34, DC-8…)
  - Water tunnel (strictly pictures, no balance)

# TFAWS Related Work at Dryden: Thermal

- Tools
  - Patran Thermal, LTA, SPAR (EAL), TPATH, analytical methods
- Significant Projects
  - Phoenix
  - Quiet Spike
  - CEV
  - TPS Health Monitoring System Development
  - NASP
  - X-planes (X-15), SR-71, many others
- Test Facilities
  - Flight Loads Laboratory
  - Small and Large Nitrogen Purged Chambers w/ quartz lamps or graphite heaters for high temp testing
    - Combined thermal and mechanical loading

# Questions